REMARKS

Claims 1- 20 were originally filed in the parent application Ser. No. 09/928,769. New claims 21-22 were added in a response to the first office action dated July 2, 2002. In a Request for Continuing Examination, claims 23-48 were added. Claims 31-48 were subject to a Restriction requirement.

In the present application (filed as a divisional application), claims 1-20 of the parent application were canceled and new claims 21-38 were added in a preliminary amendment filed concurrently with the application. The new filed claims were substantially claims 31-48 of the parent application that were subject to a restriction requirement. All amendments made to the specification in the preliminary amendment filed on January 14, 2004 were also made in the parent application.

The office action of October 5, 2004 addresses claims 1-20 of the application as filed. It was evident from the office action that the preliminary amendment filed with the present application was not entered into the application. This matter was discussed on December 22, 2004 with the Examiner. The Examiner indicated that the preliminary amendment had now been entered in the application. It does not appear that the preliminary amendment was entered completely as substantially all of the objections to the drawings and specifications in the present office action relate to matters that were completely addressed in the preliminary amendment filed with the application. This specifically includes materials in §§4A-4B; §§5A-5B and §§7A-7E of the office action.

As a courtesy, a copy of the preliminary amendment is attached. This was downloaded from the USPTO website. For some reason, page 1 of the preliminary amendment is identified as such in the website and the rest of the preliminary amendment is identified as "specifications." Clarification is requested.

In the present document, the Abstract has been amended in response to § 6 of the office action. No new matter has been added by the amendments. Reconsideration of the application as amended is respectfully requested. The Examiner's rejections in §§ 8-28 are addressed in substantially the same order as in the referenced office action.

OBJECTIONS TO THE DRAWINGS

In §3A of the office action, the Examiner has objected to figure 1 not showing component **12** which is taught on page 11 line 7 of the application. Clarification is requested as component **12** is clearly present in **Fig. 1** as filed and in **Fig. 1** of the patent publication US20040140801.

In §§4A-4B of the office action, the Examiner has raised certain objections that were dealt with in amendments to paragraph **[0019]** of the preliminary amendment filed with the present application.

The objections made by the Examiner in §5A of the office action were addressed

in amendments made to paragraphs **[0038]** and **[0042]** in the preliminary amendment filed with the present application.

The objections made by the Examiner in §5B of the office action were addressed in amendments made to paragraph **[0063]** in the preliminary amendment filed with the present application.

The Abstract has been amended in response to the objections made in §6 of the office action.

The objections made by the Examiner in 7 of the office action were addressed in amendments made to paragraphs **[0019]**, **[0020]**, **[0028]**, **[0030]**, and **[0034]** in the preliminary amendment filed with the present application.

REJECTIONS UNDER 35 USC §102

Claims 21, 22, 23, 25, 26 and 30 stand rejected under 35 USC§ 102 as being anticipated by the article "The Petrophysics of Electrically Anisotropic Reservoirs" by *Klein* et. al. Claim 21 is an independent claim.

The present invention is a method of petrophysical evaluation of an earth

formation using measurements of horizontal and vertical resistivity of the earth formation made by a logging tool. Using the measured horizontal and vertical resistivities, horizontal and vertical permeabilities are determined. The ratio of the horizontal and vertical permeabilities is different from the ratio of the horizontal and vertical resistivities.

As the Examiner has pointed out, the ratio of the horizontal to vertical permeability shown in **Figures** 7, 8, 10 and 11 of *Klein* are different from the ratio of the horizontal and vertical resistivities.

The Examiner appears to have misunderstood how the figures 7, 8, 10 and 11 in *Klein* were derived. Attention is drawn to **Eqns. (4)** and **(5)** of *Klein*. This is the basis for determining vertical and horizontal resistivities $R_{\perp}$ and $R_{//}$. These are determined from the porosity ϕ, volume fractions V_M and V_{μ} of a two component mixture, the Archie coefficients *a, m* and *n*, the water saturation S_w and the water resistivity R_w. Mercury injection capillary pressure data (MICP), (from **Fig. 1a)** are used **(see page 26 col. 2)** to get the water saturation of each lithology as a function of pressure and then get the resistivity ratio plotted in **Fig. 1b**. *Klein* further compares the results of **Fig. 1b** with actual laboratory measurements made on a rock sample **(Fig. 2)** and concludes that the "laboratory-derived resistivity ratios increase with decreasing saturation as predicted by our model." **Page 27 col. 2.**

Turning next to **Fig. 5** of *Klein*, we note that this represents a petrophysical model for the A-sand of a prospect in the Kuparuk area derived from log and core data. Note that the model is based on Formation Microscanner data from Well C, which is nearly vertical. **(page 27 col. 2 last line- page 29 col. 1, lines 1-2).** A single resistivity log is shown in track 4 of Fig. 6. The manner in which the other logs in **Fig. 6** were obtained are generally discussed at **page 29 col. 1 line 5 – page 29 col. 2 line 7.** This means that the permeability logs shown in tracks 7-9 of Figure 6 were derived from a single resistivity log. This resistivity log would be the horizontal conductivity measured by the Formation Microscanner in a vertical well.

Turning now to **Fig. 7**, we note the following at **page 29, col. 2 line 12** in *Klein*:

> "The detailed logs shown in Figure 6 were next averaged with a running filter to simulate logging tools with vertical resolution of approximately 2 ft. with results shown in Figure 7 and 8. We averaged the high-resolution log both in parallel and in series to obtain simulated parallel and perpendicular resistivity logs. The results are shown for two different values of FWL. The first case shown in Figure 7, has FWL at depth 7,200 ft….. The permeability logs shown in Figure 7 are parallel and perpendicular permeability to oil"

In other words, the parallel and perpendicular resistivity logs shown in tracks 3 and 4 of Figure 7 are **simulated logs derived from the single resistivity log of Figure 6.** The parallel and perpendicular permeability shown in 6 and 7 of Figure 7 **are derived from the ko (in track 7 of Figure 6) which in turn is derived from the single**

resistivity log of Figure 6.

Figure 8 is similar to Figure 7 with a different FWL.

Figure 9 and 10 are similar to figures 6 and 7 for a different model (Gulf Coast, instead of Kuparuk).

Claim 21 includes the determination of horizontal and vertical permeability from horizontal and vertical resistivities. As noted above, the teachings of *Klein* with reference to Figure 6 and 7, there is no teaching of deriving horizontal and vertical permeabilities from horizontal and vertical resistivities: all that is disclosed is a derivation of horizontal and vertical permeabilities from a single resistivity measured by a Formation Microscanner.

In order for a claimed invention to be anticipated by a single prior art reference, the prior art reference must disclose each and every limitation of the claim arranged as in the claim. This requirement is clearly lacking in the present case. Accordingly, applicant respectfully submits that claim 21 and claims 22-38 that depend upon claim 21 are patentable under 35 USC § 102 over *Klein.*

None of the prior art of record teaches or suggests the specific limitations of claim 1 discussed above. Accordingly, applicant further submits that claim 21 and claims 22-38 that depend upon claim 21 are also patentable under 35 USC § 103 over *Klein* and the

prior art of record.

REJECTIONS UNDER 35 USC § 103

Claims 27, 28, 32, 33, 34 and 37 stand rejected under 35 USC § 103 over *Klein*. This issue has been addressed above in the rejection under 35 USC§102 over *Klein*.

Claims 27 and 28 stand rejected under 35 USC§103 over *Klein* in view of *Hagiwara* (US5966013). The Examiner has cited **col. 3 lines 16-20** and **col. 5 line 60-col. 6 line 37** for supporting her contention that two different induction tools are taught. A careful reading of *Hagiwara* shows no such teaching. All that is disclosed is an "induction logging tool **85**, which is a conventional induction type logging tool, includes a transmitting antenna T_1, and a pair of receiving antennas R_1 and R_2 mounted on a section of a drill collar **120**." **See col. 5 lines 62-66.**

We further note that **col. 3 lines 16-20** and the following portion **col. 3 lines 22-30** describe how measurements of horizontal and vertical resistivities may be obtained in a deviated borehole using a convention induction logging tool. This is not a teaching of a transverse induction tool

The Commissioner is authorized to charge any fees for these amendments to **Deposit Account 02--0429 (584-23131-USD).**

Respectfully submitted,

Dated: June 30, 2005

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Beth Pearson-Naul

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF:	§	
Schoen et al	§	
	§	Docket No: 584-23131-US-D1
	§	Conf. No.
Serial No:	§	Art Unit: 2862
	§	
Filed: January 14, 2004	§	Examiner:
Title: Combined Characterization and	§	
Inversion of Reservoir Parameters	§	COPY
from Nuclear, NMR and Resistivity	§	
Measurements	§	

PRELIMINARY AMENDMENT

Prior to any substantive action in this case, please amend the application as indicated below. Amendments to the specifications start on page 2 of this document. Amendments to the claims start on page 10 of this document.

IN THE SPECIFICATIONS

Please amend paragraph [0001] of the application as indicated:

[0001] This application is a divisional application with a priority claim to United States Patent Application Serial No. 09/928,769 filed on August 13, 2001, now United States Patent XXXXXXX, which claimed ~~claims~~ priority from United States Provisional Patent Application Ser. No. 60/229,134 filed on August 30, 2000.

Please amend paragraph [0012] as indicated:

[0012] Co-pending United States Patent Application Ser. No. 09/539,053 (the '053 application) filed on March 30, 2000, now United States Patent 6,470,264 ("the *Mollison* '264 patent") having the same assignee as the present application, and the contents of which are fully incorporated herein by reference, discloses a method of accounting for the distribution of shale and water in a reservoir including laminated shaly sands using vertical and horizontal conductivities derived from multi-component induction data. Along with an induction logging tool, data may also be acquired using a borehole resistivity imaging tool. The data from the borehole resistivity imaging tool give measurements of the dip angle of the reservoir, and the resistivity and thickness of the layers on a fine scale. The measurements made by the borehole resistivity imaging tool are calibrated with the data from the induction logging tool that gives measurements having a lower resolution than the borehole resistivity imaging tool. The measurements

made by the borehole resistivity imaging tool can be used to give an estimate of $V_{sh\text{-}LAM}$, the volume fraction of laminar shale. A tensor petrophysical model determines the laminar shale volume and laminar sand conductivity from vertical and horizontal conductivities derived from the log data. The volume of dispersed shale, the total and effective porosities of the laminar sand fraction as well as the effects of clay-bound water in the formation are determined.

Please amend paragraph [0013] as indicated:

[0013] The method of the ~~'053 application~~ the *Mollison* '264 patent is not readily applicable to reservoirs in which the sands may be intrinsically anisotropic without making additional assumptions about the sand properties. Sands in turbidite deposits commonly comprise thin laminae having different grains size and/or sorting; the individual laminae may be isotropic but on a macroscopic scale relevant to logging applications, the laminations exhibit transverse isotropy. In addition, a reservoir including turbiditic sands exhibits an anisotropic permeability. Being able to determine this anisotropic permeability is important from the standpoint of reservoir development. This is an issue not addressed in the ~~'053 application~~ *Mollison* '264 patent and of considerable importance in development of hydrocarbon reservoirs.

Please amend paragraph [0019] as indicated:

[0019] Fig. ~~**2**~~ **2A** is a schematic external view of the unified borehole sidewall imager system. This may be used to provide the data that may be used in an optional embodiment of the invention. The tool **10** comprising the imager system includes four important components: 1) resistivity arrays **26**; 2) electronics modules **28** and **38**; 3) a mud cell **30**; and 4) a circumferential acoustic televiewer **32**. All of the components are mounted on a mandrel **34** in a conventional well-known manner. The outer diameter of the assembly is about 5.4 inches and about five feet long. An orientation module **36** including a magnetometer and an inertial guidance system is mounted above the imaging assemblies comprising resistivity array **26** and televiewer **32**. The upper portion **38** of the tool **10** contains a telemetry module for sampling, digitizing and transmission of the data samples from the various components uphole to surface electronics **22** in a conventional manner. Preferably the acoustic data are digitized although in an alternate arrangement, the data may be retained in analog form for transmission to the surface where it is later digitized by surface electronics **22.**

Please amend paragraph [0020] as indicated:

[0020] Also shown in **Fig.** ~~**2**~~ **2A** are three resistivity arrays **26** (a fourth array is hidden in this view). Referring to ~~Figs. 2 and 2A~~ Fig. 2B, each array includes 32 electrodes or buttons identified as **39** that are mounted on a pad such as **40** in four rows of eight electrodes each. Because of design considerations, the respective rows preferably are

staggered as shown, to improve the spatial resolution. For reasons of clarity, less than eight buttons are shown in **Fig. 2A.** For a 5.375" diameter assembly, each pad can be no more than about 4.0 inches wide. The pads are secured to extendable caliper arms such as **42.** Hydraulic or spring-loaded caliper-arm actuators (not shown) of any well-known type extend the pads and their electrodes against the borehole sidewall for resistivity measurements. In addition, the extendable caliper arms **42** provide the actual measurement of the borehole diameter as is well known in the art. Using time-division multiplexing, the voltage drop and current flow is measured between a common electrode on the tool and the respective electrodes on each array to furnish a measure of the resistivity of the sidewall (or its inverse, conductivity) as a function of azimuth.

Please amend paragraph **[0028]** as indicated:

[0028] In this invention, the terms "horizontal" and "vertical" are to be understood in terms of reference to the bedding planes and the anisotropy axes of the subsurface formations, i.e., "horizontal" refers to parallel to the bedding plane, and "vertical" refers to vertical to the bedding plane. Where the beds of the formation are dipping, the anisotropy axis is taken to be the normal to the bedding plane. When the borehole is inclined to the bedding plane, data from the orientation module **36** in ~~**Fig. 1**~~ **Fig. 2A,** may be used to correct the resistivity measurements made by the resistivity imaging tool to give measurements parallel to and perpendicular to the bedding planes.

Please amend paragraph [0030] as indicated:

[0030] Referring now to ~~Fig. 4~~ Figs. 4A and 4B, one optional embodiment of the invention starts with data acquired by a borehole resistivity imaging tool such as is described in United States Patent 5,502,686 issued to *Dory* et al., and the contents of which are fully incorporated here by reference. It should be noted that the *Dory* patent is an example of a device that can be used for obtaining measurements borehole resistivity measurements: any other suitable device could also be used. The process of the invention starts with an initial model **101** for the structure of the reservoir. This initial model comprises a laminated shale fraction and a sand fraction. This initial model may be derived from the resistivity imaging tool described above. A horizontal and vertical conductivity $C_{sh\text{-}lam,h}$ and $C_{sh\text{-}lam,v}$) of the shale fraction is assumed or is measured **103**; if measurements are to be made within a borehole, this may be done by using a Transverse Induction Logging Tool (TILT) on a thick section of shale in proximity to the reservoir. The resistivity of the "bulk" shale may also be obtained from core measurements.

Please amend paragraph [0034] with as indicated:

--[0034] As described in the *Mollison* ~~'053~~ '264 patent and the '967 application ~~applications~~, measurements $R_{t,h}$ and $R_{t,v}$ made by TILT or other suitable device 109 are inverted **111** to give an estimate of the laminar shale volume and the sand conductivity, assuming that the sand component is isotropic. In terms of resistivity,

$$R_{sd} = \frac{1}{2} \cdot \left\{ \left(R_{sd}^{iso} + R_{sh-l,m} \right) + \left(R_{sd}^{iso} - R_{sh-l,v} \right) \cdot \sqrt{(1 + \Delta R)} \right\} \qquad (5)$$

where

$$R_{sd}^{iso} = R_{t,h} \cdot \frac{R_{t,v} - R_{sh-l,v}}{R_{t,h} - R_{sh-l,h}} \quad \Delta R = 4 \cdot R_{sd}^{iso} \cdot \frac{R_{sh,v} - R_{sh-l,h}}{\left(R_{sd}^{iso} - R_{sh-l,v} \right)^2} \qquad (6)$$

R_{sd}^{iso} is the 'isotropic' sand resistivity. If the shale is isotropic, ($R_{sh,h} = R_{sh,v}$), then this resistivity is identical to the sand resistivity. ΔR is the correction for anisotropic shale. ΔR becomes zero for an isotropic shale ($R_{sh,h} = R_{sh,v}$).

Please amend paragraph [0038] as indicated:

[0038] If the answer at 117 is "No", then this is an indication that the sands component is anisotropic 121. In this case, the TILT resistivity data are inverted **123** using the value of $V_{sh-l,\,TS}$ obtained at 107, e.g., using Thomas-Stieber and the method of the '049 application or the method of the '053 application, to give a water saturation S_w and bulk volume of hydrocarbons 125.

Please amend paragraph [0040] as indicated:

[0040] The sand anisotropy with resistivity values $R_{sd,h}$ and $R_{sd,v}$ is indicative of a laminated sand layer. These values of $R_{sd,h}$ and $R_{sd,v}$ are inverted to give a layered model

131 comprising isotropic sand layers and the laminated shale component determined above. In order to perform this inversion, an estimate of the number and thicknesses of the sand layers is required. This may be obtained from a resistivity imaging tool as discussed in the *Mollison* ~~'053~~ 264 patent and '967 application ~~applications~~ or it may be obtained using NMR data **127**. From the distribution of relaxation times T_1 and T_2 of NMR data, a distribution of volume fractions of individual sand components **133** may be obtained using known methods. Alternatively, core information or sedimentologic information about the reservoir may be used to give the volume fractions of the sand components.

Please amend paragraph **[0042]** as indicated:

[0042] Using assumed values for the water saturated sand in horizontal and vertical direction $R_{0,sd,h}$ and $R_{0,sd,v}$ the water saturation of the individual sand layer $S_{w,i}$ (i-th layer) are calculated separately ~~**135**~~ 137 using the layer resistivity $R_{sd,i}$ obtained at **131**. Depending on the saturation equation (Archie-equation, Waxman-Smits- equation) the following parameters are necessary as input 135: (i) Formation water resistivity, (ii) porosity or formation factor of the layer, (iii) saturation exponent of the layer, and, (iv) Waxman-Smits-parameters in case of dispersed shale in the sand layer.

Please amend paragraph **[0062]** as indicated:

[0063] Fig. 7a shows the relationship 301 between BVI_c and BVI_r for a range of assumptions of Vc between 0.1 and 0.6, i.e., all the solutions fit the measured resistivity values R_v and R_h.

Please amend the Abstract as indicated:

The ~~present invention is method of determining the~~ distribution of shales, sands and water in a reservoir including laminated shaly sands using vertical and horizontal conductivities is derived from nuclear, NMR, and multi-component induction data. The multicomponent ~~such as from a Transverse Induction Logging Tool (TILT). Making assumptions about the anisotropic properties of the laminated shale component and an assumption that the sand is isotropic, the TILT~~ data are inverted and an. ~~An~~ estimate of the laminated shale volume from this inversion is compared with an estimate of laminated shale volume from nuclear logs. The ~~using a Thomas-Stieber and Waxman-Smits model. A difference between the two estimates is an indication that the sands may be anisotropic. A check is made to see if~~ a bulk water volume determined from the inversion is compared with ~~greater than~~ a bulk irreducible water volume from NMR measurements. ~~In one embodiment of the invention,~~ NMR data are then used to obtain a sand distribution in the reservoir and this ~~This~~ sand distribution is used in a second inversion of the ~~TILT~~ multicomponent data. Alternatively ~~, assuming that the sand comprises a number of intrinsically isotropic layers, to give a model that comprises laminated sands including water and dispersed clay, laminated shales and clay bound water. In another~~

~~embodiment of the invention~~, a bulk permeability measurement is used as a constraint in inverting the properties of the anisotropic sand component of the reservoir. From the resistivities of the sand laminae, empirical relations are used to predict anisotropic reservoir properties of the reservoir.

AMENDMENTS TO THE CLAIMS

Please cancel claims 1-20.

Please add the following new claims:

21. (new) A method of petrophysical evaluation of an earth formation using a logging tool conveyed in a borehole in said formation, the method comprising:

  (a) obtaining values of a horizontal and vertical resistivity of said earth formation using said logging tool; and

  (b) determining a horizontal and vertical permeability of said earth formation using said horizontal and vertical resistivities, said horizontal and vertical permeabilities having a ratio different from a ratio of said vertical and horizontal resistivities.

22. (new) The method of claim 21 wherein said earth formation comprises a sand component and a shale component.

23. (new) The method of claim 21 wherein determining said horizontal and vertical permeabilities further comprises determining a water content of said formation from said horizontal and vertical resistivities.

24. (new) The method of claim 23 wherein determining said horizontal and vertical permeabilities further comprises determining an estimate of bulk irreducible water

content of the formation from NMR measurements.

25. (new) The method of claim 23 wherein determining said water content of said formation further comprises:

(i) inverting said values of horizontal and vertical resistivities of the formation using a petrophysical model to give a first estimate of fractional volume of laminated shale in the formation;

(ii) obtaining measurements of density and/or neutron porosity of the formation and using a volumetric model for deriving therefrom a second estimate of fractional volume of laminated shale; and

(iii) if said second estimate of fractional shale volume is greater than said first estimate of fractional shale volume, inverting said horizontal and vertical resistivities using a petrophysical model including said second estimate of fractional shale volume and obtaining therefrom a water content of the formation.

26. (new) The method of claim 21 further comprising determining a vertical and horizontal resistivity of an anisotropic sand component of the formation, and determining therefrom and from at least one additional measurement selected from the group consisting of: (i) NMR measurements of the formation, and, (ii) a bulk permeability of the sand component, a parameter of interest of a coarse and a fine grain portion of the sand component.

27. (new) The method of claim 21 further comprising using a transverse induction logging tool for obtaining said values of horizontal and vertical resistivities of the formation.

28. (new) The method of claim 21 further comprising using an induction logging tool for obtaining said values of horizontal resistivities and a focused current logging tool for obtaining said values of vertical resistivities

29. (new) The method of claim 25 wherein using said volumetric model further comprises using at least one of: (i) the Thomas-Stieber model, and, (ii) the Waxman-Smits model.

30. (new) The method of claim 21 wherein further comprising determining a parameter of interest is selected from the group consisting of: (A) a fractional volume of said coarse grain component, (B) a fractional volume of said fine grain component, (C) a water saturation of said coarse grain component, (D) a water saturation of said fine grain component, (E) a permeability of said coarse grain component, and, (F) a permeability of said fine grain component.

31. (new) The method of claim 26 wherein the at least one additional measurement comprises an NMR measurement, and deriving the parameter of interest further

comprises deriving a distribution of relaxation times from said NMR measurements and obtaining therefrom a distribution of components of said anisotropic sand.

32. (new) The method of claim 26 wherein the at least one additional measurement comprises a bulk permeability measurement of the anisotropic sand and deriving the parameter of interest further comprises:

A. obtaining a family of possible distributions of volume fractions and bulk irreducible water content (BVI) for the coarse and fine sand components;

B. determining horizontal, vertical and bulk permeability values associated with said family of possible distributions; and

C. selecting from said family of possible distributions the one distribution that has a determined bulk permeability substantially equal to the measured bulk permeability.

33. (new) The method of claim 32 wherein said bulk permeability is obtained from the group consisting of (I) NMR diffusion measurements, (II) a formation testing instrument, (III) a pressure buildup test, and, (IV) a pressure drawdown test.

34. (new) The method of claim 32 wherein determining the horizontal and vertical permeability values associated with said family of distributions for the coarse and

fine sand components further comprises using the Coates-Timur equation

$$k = \left(\frac{\phi}{C}\right)^{a} \cdot \left(\frac{\phi - BVI}{BVI}\right)^{b}$$

where k is a permeability, ϕ is a porosity, BVI is the bound volume irreducible, and a, b, and C are fitting parameters.

35. (new) The method of claim 32 wherein determining horizontal, vertical and bulk permeability values further comprises using a relationship of the form

$$k = C\phi^{a}T^{b}$$

where k_e is a permeability, ϕ is a porosity and T is a NMR relaxation time, and a, b, and C are fitting parameters.

36. (new) The method of claim 35 wherein T is a longitudinal NMR relaxation time.

37. (new) The method of claim 32 wherein the coarse sand portion of the selected distribution is characterized by an irreducible water saturation less than an irreducible water saturation of the fine grain sand portion of the selected distribution.

38. (new) The method of claim 32 wherein the determined bulk permeability is a

spherical permeability related to the horizontal and vertical permeability values by a relationship of the form

$$k_{sph} = \left(k_h^2 k_v\right)^{\frac{1}{3}}.$$

REMARKS

Claims 1- 20 were originally filed in the parent application Ser. No. 09/928,769. New claims 21-22 were added in a response to the first office action dated July 2, 2002. In a Request for Continuing Examination, claims 23-48 were added. Claims 31-48 were subject to a Restriction requirement. The parent application has been allowed.

In the present application (filed as a divisional application), claims 1-20 of the parent application have been canceled and new claims 21-38 have been added. The new claims are substantially claims 31-48 of the parent application that were subject to a restriction requirement. All amendments made to the specification herein were also made in the parent application and entered by the Examiner.

New independent claim 21 includes a limitation of determining horizontal and vertical permeabilities that have a ratio different from a ratio of the vertical and horizontal resistivitites. The horizontal and vertical permeabilities given by eqns (27) - (28) are a complicated function of the horizontal and vertical resistivities. There is no reason to expect that the permeability anisotropy ratio (ratio of horizontal and vertical permeabilities) be the same as the resistivity anisotropy ratio. This is borne out by examples given in the specification in paragraphs [0065] - [0066], and specifically in Table I. Reasons for the difference are discussed in paragraph [0066]. It should further be pointed out that equation (14) of the *Klein* reference (the closest reference cited by the Examiner in the parent application) gives a permeability anisotropy ratio that is the same

as the resistivity anisotropy ratio.

For these reasons, Applicant respectfully submits that claim 21 and claims 22- 38 that depend upon claim 21 are also patentable under 35 §§ 102-103 over *Klein* and the prior art of record.

The Commissioner is authorized to charge any fees for these amendments to **Deposit Account 02—0429 (584-23131-US-D1).**

Dated: January 14, 2004

Respectfully submitted,

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TITLE: Combined Characterization and Inversion of Reservoir Parameters from Nuclear...

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DELIVERY (POSTAL USE ONLY)		
Delivery Attempt Mo. Day	Time ☐ AM ☐ PM	Employee Signature
Delivery Attempt Mo. Day	Time ☐ AM ☐ PM	Employee Signature
Delivery Date Mo. Day	Time ☐ AM ☐ PM	Employee Signature

WAIVER OF SIGNATURE (Domestic Only) Additional merchandise insurance is void if waiver of signature is requested. I wish delivery to be made without obtaining signature of addressee or addressee's agent (if delivery employee judges that article can be left in secure location) and I authorize that delivery employee's signature constitutes valid proof of delivery.

NO DELIVERY ☐ Weekend ☐ Holiday

Customer Signature

CUSTOMER USE ONLY
METHOD OF PAYMENT:
Express Mail Corporate Acct. No. X770637

Federal Agency Acct. No. or Postal Service Acct. No.

FROM: (PLEASE PRINT) PHONE ( )

MADAN MOSSMAN & SRIRAM
ATTORNEYS AT LAW
2603 AUGUSTA DR STE 700
HOUSTON TX 77057-5662

584-23131-USD

TO: (PLEASE PRINT) PHONE ( )

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MS: Patent Application

FOR PICKUP OR TRACKING CALL 1-800-222-1811 www.usps.com